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RETHINKING BURN WOUND DRESSING IN RESOURCE-LIMITED ENVIRONMENTS: A NARRATIVE REVIEW
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ABSTRACT

Background: **Burn injuries result in significant physical pain and psychological trauma that extend beyond the initial insult. In low-resource settings, paraffin-impregnated gauzes often adhere to wounds, causing procedural pain, which is commonly reported during the removal of dry dressings.**

Objectives: **The review synthesizes strategies implemented in high-resource settings, analyses barriers to their adoption in resource-limited environments, and proposes pragmatic solutions for low-resource settings.**

Data Sources: **This review draws upon literature from PubMed, Google Scholar, and African Journals Online (AJOL).**

Study Selection: **Studies were selected for their relevance to dressing adherence, pain, and resource constraints. 99 articles were collected and screened using Zotero and Rayyan.**

Data extraction: **Data were tabulated to capture key characteristics, including titles, settings, dressing types, pain adherence outcomes, frequency of dressing changes, key insights, possible adaptations for low- and middle-income countries, populations, and study types.**

Data synthesis: **Data were synthesized narratively within the clinical context of Kenyatta National Hospital, Kenya. Findings were categorized by dressing type and availability.**

Conclusions: **In high-resource settings, pain management strategies include both pharmacologic and non-pharmacologic interventions. Some approaches involve reducing the frequency of dressing changes and employing truly non-adherent dressings. Adaptable solutions include cost-effective non-adhesive wound dressings, pre-soaking dressings before removal, analgesia before dressing changes, distraction therapies, aromatherapy, longer-wear dressings, and staff training in pain-minimizing techniques. While the causes of burns vary among patients, evidence indicates that pain during hospital dressing procedures is largely preventable.**

Keywords: **Pain; Wound dressing; Burns; Resource-Limited Settings**

INTRODUCTION

Burns are a significant cause of morbidity and mortality globally, with the majority of the burden being in low- and middle-income countries (1). Wound care is critical in burn care, as it can improve or delay wound healing. Improper wound dressing may delay healing via both physical and psychological mechanisms (2). Patients get wound care-associated anxiety (3). Thus, procedural pain causes psychological stress, effectively retraumatizing the patient with each change of dressing (4,5). Stress is known to delay wound healing. Delays in wound healing not only prolong morbidity but also contribute to financial burden for the patients, their caregivers and entire healthcare systems.

In low-resource settings, even non-adherent wound dressings, such as paraffin-impregnated gauzes, commonly adhere to wounds, causing procedural pain during wound dressing changes due to avulsion of granulation tissue. While high-resource settings

may offer many solutions, they often prove costly in low-resource settings.

This review aims to analyze strategies to minimize pain in high-income countries, identify barriers to their implementation in low- and middle-income settings, and provide feasible solutions for low- and middle-income countries, contextualized for Kenyatta National Hospital.

METHODOLOGY

Scope and Objectives
The objective of this narrative review is to identify and synthesize strategies used in high-resource settings to mitigate pain during wound care, analyze barriers to their implementation in low-resource settings, and propose feasible alternatives for these settings.

Information Sources
1. Pubmed
2. African Journals Online (AJOL)
3. Google Scholar

Search Strategy
The search was done using combinations of the terms related to and inclusive of 'pain' (such as 'analgesia' 'dressing pain', 'adherence', 'stuck', 'dressing' 'adherence', and 'sedation'), 'wound dressing' (such as 'non-adherent dressing', 'paraffin dressing', 'paraffin gauze', 'burn dressing', and 'moist wound dressing') and 'burns' (and 'burn wound'), and included studies published up to November 2025.

Study Selection Approach
Search results from PubMed (48 papers), AJOL (17 papers), and Google Scholar (34 papers) were exported into Rayyan for screening. After removal of duplicates (3), titles and abstracts were assessed for relevance. Fifty studies were excluded for not meeting the review's scope. Full texts of the remaining articles were reviewed, leading to the exclusion of an additional 4 studies. Ultimately, 42 articles were included in the final narrative review.

Inclusion/Exclusion Rationale
Studies were included if they addressed pain during wound dressing, proper wound dressing techniques, or wound dressing in low-resource settings. Exclusion criteria included non-English articles, animal studies, and articles written before 2015.

Narrative Synthesis Approach
Data from the included studies were synthesized narratively and organized into thematic categories: pain relief techniques (pharmacologic and non-pharmacologic), pain-free dressings (such as non-adherent dressings), dressings incorporating analgesics, and dressings with intrinsic pain-relieving properties, for example, biologic dressings), and recommendations tailored for low-resource settings.

DISCUSSION

How Burn Dressings Cause Pain in Low-Resource Settings: The mechanisms and the real-world ward reality
Burn patients experience various types of pain, including acute, chronic, background, breakthrough, and procedural pain (6). Wound dressings, particularly dry dressings, can adhere to the wound, resulting in procedural pain during removal (6,7). Locally, patients frequently present with burns affecting at least 20% of the Total Body Surface Area (TBSA), and dressing adhesion over such extensive areas leads to severe pain.

Patients with partial-thickness and full-thickness burns frequently require debridement and skin grafts, resulting in postsurgical pain, baseline pain from the burn, and breakthrough pain during wound dressing. Partial-thickness burns are excruciating due to exposed nerve endings, and infection can exacerbate this pain by further inflaming the area. The graft donor site constitutes another area requiring wound care, thereby increasing the Total Body Surface Area experiencing pain during dressing changes. Postsurgical pain can prolong wound healing time (2). Dressing adherence not only delays healing by causing severe pain but also disrupts epithelialization, removing fragile epithelial cells and granulation tissue. Dressings necessitating frequent changes inflict repeated psychological and physical trauma (6,7). This phenomenon is especially pronounced in paediatric patients, whose dressing times are extended due to resistance stemming from extreme pain (8). In these settings, neither pharmacologic nor non-pharmacologic pain management techniques are routinely employed. Additionally, staff face increased workloads.

Biogras™, a paraffin gauze dressing containing chlorhexidine as an antiseptic, is commonly utilised at Kenyatta National Hospital. The paraffin component is designed to minimize adhesion, retain moisture, and facilitate epithelial migration during wound healing. Despite its intended low-adherence properties, the paraffin tulle gauze often adheres to wounds as it

dries, causing pain during dressing changes. At Kenyatta National Hospital, this dressing is typically removed six days after application, although it can be changed every 24–48 hours. However, increasing the frequency of dressing changes can result in additional trauma to the healing site.

What High-Resource Settings Do and Why We Can't Copy It Fully

High-resource settings provide many solutions to the problem at hand. They include:

1. Minimizing the frequency of dressing change using ideal dressings.

   Dressings that permit this include biologic, hydrocolloid, composite, alginate, and hydrofibre dressings (9–11).

2. Using non-adherent dressings.

   These include hydrogels, hydrocolloids, alginates, hydropolymer fibres, biological dressings, foam dressings, composite dressings, silicone dressings, and Polymer membrane dressings.

3. Pharmacologic approaches

   These include deep sedation with propofol-ketamine, nitrous oxide, or propofol-ramifentanil before wound dressing (12,13). A local anaesthetic, lidocaine, has also been put to use for this (14). To reduce the baseline pain, opioids such as morphine, sufentanil and oxycodone within the wound dressing have been used (15–18).

4. Non-pharmacologic approaches

   These include aromatherapy with damask rose (a sensory-diverting intervention), distraction from the nociceptive stimuli, which consists of active and passive Virtual Reality (VR) and smartphones and other digital devices such as iPads in the paediatric population, and relaxation techniques which include progressive muscle relaxation and breathing exercises (19–24). Others include hypnosis and music therapy, which result in the reduction of anxiety related to wound dressing and a decrease in the amount of opioid use (24,25).

   In lower- and middle-income countries (LMICs), hospitals frequently contend with understaffing, limited access to advanced dressings due to cost and availability, and high patient volumes requiring urgent care in resource-constrained environments. Although numerous studies indicate that Virtual Reality can reduce perceived pain, this technology remains inaccessible and unfamiliar in Kenya.

Evidence on Dressing Types (Non-Adherent Vs Adherent)

The primary purpose of wound dressings is to provide physical protection to the wound, maintain an optimal moisture level, and absorb wound fluids. There are basic and advanced types of wound dressings. The choice of wound dressing is determined by whether the wound is acute or chronic, whether it is draining, and its depth (26).

The types of wound dressings are summarised in Tables 1, 2 and 3 (26). The summary of the dressings available in Kenyatta National Hospital is shown in Table 4.

Table 1: Adherent wound dressings and information on their availability in Kenyatta National Hospital

	Adherent		Availability
Gauzes	Gauzes are beneficial in that they are widely available and can be used with other dressings for occlusiveness. Due to their adherent nature, gauzes traumatise the wound during removal. They are also permeable to bacteria and leave residual material that may lead to granuloma formation. Gauzes may be impregnated with petrolatum / paraffin to reduce adhesion, but can still adhere to the wound.	They can be used for infected and non-infected wounds of any shape or size.	Available

Films	Films, being made of transparent polyurethane, enable one to see the wound as it heals. They are protective from contamination and bacteria while still allowing for air to enter and exit. Nonetheless, they have a poor absorptive capacity.	Films are used for non-exudative or mildly-exudative superficial wounds. They are not for dry or infected wounds.	Available

Table 2: Non-adherent wound dressings and information on their availability in Kenyatta National Hospital

Non-Adherent			Availability
Hydrogels	Hydrogels can either be water-based or glycerin-based. This allows them to soften eschars. They reduce pain by providing a cooling sensation and not adhering to the wound, thus avoiding any tensile or frictional injury to the wound. Nevertheless, due to their poor absorption, they should not be used on infected wounds or heavily draining wounds.	They are useful for dry, mild and moderately draining wounds.	Available
Hydrocolloids	Hydrocolloids are made of carbosymethylcellucolse, gelatin and pectins. They are of 2 types, gel and sheet hydrocolloids. They can remain unchanged for many days. On the other hand, they may cause contact dermatitis.	They are used on dry wounds that are abrasions, superficial pressure ulcers, surgical wounds, graft sites and burns.	Unavailable
Alginates	They are polysaccharides obtained from algae and kelp, and contain calcium, which plays a role in platelet activation. The calcium reacts with sodium to form a sodium-calcium gel that prevents moisture loss. Furthermore, they can remain unchanged for many days. Notably, it becomes adherent if it is used on dry wounds.	Alginates can be used for both infected and non-infected heavily exudative wounds.	Unavailable
Hydrofibres	Hydrofibres are made of Carbosymethylcellulose fibres that hold more fluids than alginates and can remain unchanged for many days.	Hydrofibres can be used for both infected and non-infected heavily exudative wounds.	Available

Foams	Foams are versatile, affordable and easy to use. They have 3 layers - a hydrophobic semipermeable outer layer that prevents entry of bacteria and allows passage of air, a middle layer that is absorptive to maintain moisture, and an inner layer that enables movement of fluids from the wound to the middle layer, without adhering to the granulation tissue due to its small size. Notably, foams absorb fluids faster than alginates; therefore, they require dressings to be changed more often.	For infected or non-infected wounds that are moderately to heavily exudative.	Available
Composite	Composite dressings have an inner layer that, much like the foams, draws moisture from the inner layer to the 2nd layer, which may be alginate, foam, hydrocolloid or hydrogel. They enable less frequent dressing changes. Nevertheless, they are expensive.		Unavailable
Biologic dressings	Biologic dressings reduce pain, provide a moist wound environment, and require fewer dressing changes. They separate as the wound heals and promote faster wound healing by providing components required for healing, such as fibroblasts, macrophages, collagen, and calcium. However, they could cause adverse inflammatory reactions, infections or contribute to contamination.	They are used when using conventional dressings is not feasible.	Available, sometimes reliant on donations
Polymer membrane dressings	Polymer membrane dressings may or may not be non-adherent. They interact with nociceptors to reduce pain. One significant benefit is that they reduce odour from the wound. They are also moisturising due to their inner layer, despite the dressing's moisture-drawing nature.	They can be used for both infected and non-infected wounds that are dry or exudative, from mild to heavily exudative.	Available

Table 3: Antimicrobial wound dressings and information on their availability in Kenyatta National Hospital

Antimicrobial Dressings	Availability
Antimicrobial dressings may or may not be non-adherent. They may contain iodine (Povidone-iodine or cadexomer-iodine) or silver. They can be topical agents added to other wound dressings. Due to the harmful nature of the chemicals, they require frequent wound dressing. The topical agents are hydrogen peroxide (Dakin's solution), hydrogen peroxide with boric acid (Eusol solution) and acetic acid. Topical antibiotics used include mupirocin, which provides moisture but may lead to bacterial antimicrobial resistance.	Silver dressings, Dakin's solution, and topical antibiotics are available.

Other dressings include protease-lowering dressings, phosphorylated cotton dressings, and proteolytic enzyme preparations.

Table 4: Summary of dressings available at Kenyatta National Hospital

Available	Unavailable
Gauzes, films, hydrogels, hydrofibres, foams, polymer membrane dressings, and (occasionally) biologic dressings are available.	Hydrocolloids, alginates, and composite dressings are unavailable.

Practical Options for Low-Resource Settings
Based on the literature and ward-level observations, the following recommendations are suggested to reduce the pain experienced during wound dressing in resource-limited settings:

Dressing materials
Recommendations include incorporating more hydrogel dressing use, switching to hydrocolloid dressings (especially for donor site dressings), adding more sterile paraffin to the available paraffin-impregnated gauzes, pre-soaking dressings before removal, the use of inexpensive silicone alternatives (such as hydrocolloid, hydrogel, polymeric film and chitosan-based dressings) and the use of longer-wear dressings to reduce the frequency of dressing changes.

Standardised analgesia protocols
Using simple, written protocols for pre-dosing with oral or IV analgesia at fixed times before dressing (for example, 30–45 minutes) would help make the patient's hospital experience better. Additionally, clustering the most painful dressings at times when more experienced staff and monitoring are available, and using simple validated pain scales (such as the Wong–Baker FACES pain rating scale) before and after dressing to trigger escalation of pain control are recommended.

Non-pharmacologic interventions that do not require VR
Recommended approaches include distraction therapy, such as music therapy, mobile games, laminated pictures, simple toys, story cards, or bubble blowing for young children. Pre-loaded playlists (via a cheap speaker or a phone) can be consistently used during paediatric dressing times. Other recommendations include allowing a caregiver to be present for paediatric dressings to assist with distraction and comfort (if it does not interfere with sterility) and structured psychological preparation and explanation. The patients can be given brief, standardised scripts explaining what will happen and how long it will take, which can reduce anticipatory anxiety. Moreover, nurses can be trained to lead 1–2 minutes of slow breathing or distraction conversation before and during dressing.

Organisational / systems changes
Staff can be trained on gentle dressing removal techniques. Moreover, a short checklist (such as: analgesia given? solution prepared for pre-soak? distraction ready? staff aware of plan?) can be used to standardise good practice. Finally, simple audits of reported dressing pain and adherence incidents, with feedback at ward meetings can be done to gradually improve practice.

Evidence Gaps
Aromatherapy, the non-pharmacological approach, should be further investigated for effectiveness, as only one included study reported its use. As for pharmacologic agents like opioids, though proven to be effective, they are associated with numerous

adverse effects, and sedation necessitates rigorous monitoring.

CONCLUSION

Wound dressing in resource-limited settings is both mentally and physically taxing, often resulting in delayed wound healing. Paraffin-impregnated gauzes, which are commonly used in these environments, tend to adhere to wounds and cause pain upon removal. Potential solutions in low-income settings include pre-soaking dressings before removal, utilising inexpensive silicone or other non-adhesive alternatives, administering analgesia such as opioids before dressing changes, employing distraction therapies (such as music therapy or mobile games), incorporating aromatherapy where available, using longer-wear dressings to reduce dressing frequency, and providing staff training on gentle removal techniques. While non-pharmacologic approaches like aromatherapy remain under debate, current evidence suggests they can effectively reduce perceived pain in many patients.

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